

Building language interfaces with Vaucanswig

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This document describes how to use Vaucanswig to produce interfaces with other languages.

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Background

Vaucanswig is a set of [SWIG](#) wrapper definitions for the [Vaucanson](#) library.

SWIG takes Vaucanswig as input, and generates code to link between any supported scripting language and C++. In that sense, Vaucanswig is already “meta”, because it ultimately supports several scripting languages. But still, even Vaucanswig itself is automatically generated, and this “meta-build” process is described in a separate document.

The document you are reading explains how to *use* Vaucanswig once it has been generated.

General idea

Once Vaucanswig has been generated, it is composed of *input files* to SWIG.

To use Vaucanson in a target scripting language, two steps are necessary:

1. Produce C++ sources for the interface (running SWIG).
2. Compile these sources.

Step 1 only requires Vaucanswig sources and a decent version of SWIG.

Step 2 requires the Vaucanson library and the extension libraries for the selected target language.

SWIG modules (MODULES)

Vaucanswig defines a number of SWIG modules.

The list of SWIG modules, hereinafter named MODULES, contains:

| Name of module | Description |
|----------------|--|
| core | the core of vaucanswig. |
| K_context | for each K , the definition of the algebraic context K (“K” can be “usual”, “numerical”, “tropical” and so on) |
| K_automaton | definition of the Automaton and Expression types in context K |
| K_alg_A | for each algorithm A , the definition of the specific instance of A in context K . (A can be “complete”, “standard”, “product” and so on) |
| K_algorithms | a convenient wrapper for context K with “shortcuts” to all the algorithms instanciated for K . |

Note that the name of SWIG modules are closely related to the namespace where the corresponding features can be found in the target scripting language.

Then, for each module M , two items are available:

| Item | Description |
|--------------------|--|
| src/vaucanswig_M.i | the dedicated SWIG source file |
| src/M.deps | (optional, may not exist) a file containing a list of modules that M is dependent upon. If the file is empty, two cases apply: <ul style="list-style-type: none">• M is “core” - no dependency• M is not “core” - it depends on “core”. |

The first item is the most important. The second is only useful to create automated build processes which require dependency rules.

C++ sources specific to the target scripting language (T.S.L.)

Each TSL needs a different set of wrapper for the Vaucanswig modules.

For any given TSL, source files for the MODULES can be created by SWIG by running the following pseudo-algorithm:

```
$ for M in ${MODULES}; do
    ${SWIG} -noruntime -c++ -${TSL} \
        -I${VAUCANSWIGDIR}/src \
        -I${VAUCANSWIGDIR}/meta \
        -I${VAUCANSON_INCLUDES} \
        ${VAUCANSWIGDIR}/src/vaucanswig_${M}.i
done
```

Where:

- $\text{\texttt{\$TSL}}$ is the SWIG option pertaining to the language (python, java ...)
- $\text{\texttt{\$VAUCANSWIGDIR}}$ is the root directory of Vaucanswig.

- `SWIG` is the path to the SWIG binary.
- `VAUCANSON_INCLUDES` is the base directory of the Vaucanson library.

Compilation of the binaries for the target scripting language

The previous step creates a bunch of C++ source files of the form:

```
vaucanswig_{$M}_wrap.cxx
```

They should be compiled with the C++ compiler supported by the TSL.

The C++ compilation should use the following flags:

`-DINTERNAL_CHECKS -DSTRICT -DEXCEPTION_TRAPS`: Use for more secure code in Vaucanson.

`-I$VAUCANSON_INCLUDES`: Specify the location of the Vaucanson library headers.

`-I$VAUCANSWIGDIR/src -I$VAUCANSWIGDIR/meta`: Needed by Vaucanswig.

In addition, any “compatibility” flags required by Vaucanson for this particular C++ compiler should be used as well.

Automake support for Python as a TSL

According to the previous section, a `Makefile.am` file is generated in the subdirectory `python/`.

It contains four main parts:

- A header:

```
##
## Set INCLUDES for compilation of C++ code.
##

# FIXME: the python path is hardcoded, this is NOT good.
INCLUDES = -I/usr/include/python2.2 \
           -I$(srcdir)/../src -I$(srcdir)/../meta \
           -I$(top_srcdir)/include -I$(top_builddir)/include

##
## Set AM_... flags.
##

# According to spec.
AM_CPPFLAGS = -DINTERNAL_CHECKS -DSTRICT -DEXCEPTION_TRAPS
# We want lots of debugging information in the wrapper code.
AM_CXXFLAGS = $(CXXFLAGS_DEBUG)
# For Libtool, to generate dynamically loadable modules.
AM_LDFLAGS = -module -avoid-version
```

- The list of binary targets (the shared objects - DLL):

```
# for each MODULE:
pyexec_LTLIBRARIES += libvs_$(MODULE).la
```

- The list of Python source files:

```
# for each MODULE:
python_PYTHON += vaucanswig_$(MODULE).py
```

- Build specifications for binary targets:

```
# for each MODULE:
libvs_$(MODULE)_la_SOURCES = vaucaanswig_$(MODULE)_wrap.cxx

# If the module is "core":
#   # This should be the only dependency against static, non-template
#   # Vaucanswig code. And make it a dependency to the SWIG runtime.
#   libvs_core_la_LIBADD = ../meta/libvv.la -lswigpy

# Else:
#   If src/$(MODULE).deps is empty:
#       libvs_$(MODULE)_la_LIBADD = libvs_core.la
#   Else:
#       for each DEPENDENCY in src/$(MODULE).deps do:
#           libvs_$(MODULE)_la_LIBADD += libvs_$(DEPENDENCY).la
```

Additionally, the following (not important) parts are generated for convenience purposes:

- Rules to rerun SWIG in case something changes in Vaucanswig:

```
vaucaanswig_*_wrap.cxx vaucaanswig_*.py: ../src/vaucaanswig_*.i
    $(SWIG) -noruntime -c++ -python -I... \
        -o vaucaanswig_*_wrap.cxx \
        ../src/vaucaanswig_*.i
```

- Installation and uninstallation hooks.

Automake support for the TSL-independent code

In order to make things comply to the spirit of the Autotools, a convenience `Makefile.am` is generated in the `src/` directory.

It contains a definition of `EXTRA_DIST` with all the SWIG module source files, of the form: `vaucaanswig_$(MODULE).i`